

CLAIMS:

Having thus described our invention, what we claim as new and desire to secure by

5 Letters Patent, is:

1. A process by which a target design may be assembled on a computer terminal and
used to pattern, on a pixel-by-pixel basis, the surface of a selected substrate, said
process comprising the steps of:
 - 10 a. assembling on said terminal a desired subject image and any desired artistic
enhancements into a digitally-defined target design suitable for patterning a
specified area on said substrate;
 - 15 b. transmitting, using an electronic communications link, said digitally-defined
target design to a remotely-located patterning device comprising an array of
individually-addressable liquid colorant applicators;
 - 20 c. transforming electronically said digitally-defined target design into a series of
actuation commands to be sent to said array of individually-addressable
colorant applicators; and
 - 25 d. actuating selected individually-addressable colorant applicators in accordance
with said actuation commands and dispensing, on a pixel-by-pixel basis onto
said specified area of said substrate surface, controlled quantities of liquid
colorant, thereby forming said digitally-defined target design on said defined
area.
2. The process of Claim 1 wherein said electronic communications link comprises the
30 Internet.
3. The process of Claim 1 wherein said substrate is an absorbent substrate having a
pile surface.

4. The process of Claim 1 wherein said substrate is a decorative textile substrate selected from the group consisting of carpets, rugs, carpet tiles, and wall hangings.
5. The process of Claim 7 wherein said subject image is selected from a database, accessible from said terminal, containing a collection of images.
6. The process of Claim 1 wherein said desired artistic enhancements are selected from a database accessible from said terminal.
7. The process of Claim 1 wherein said subject image is selected from a group consisting of images of pets, sports designs, heraldry, nature scenes, outdoor scenes, landscapes, famous works of art, famous works of architecture, modes of transportation, famous personalities, holiday motifs, collectible articles, and maps.
8. The process of Claim 7, wherein said subject image originates as a photograph.
9. The process of Claim 7, wherein said subject image is accessed by a scanning device.
10. The process of Claim 1 wherein said computer terminal is located in a residence.
11. The process of Claim 1, wherein said computer terminal is located in a commercial establishment in which most revenue is derived from the sale of carpets, rugs, carpet tiles, and wall hangings.
12. The process of Claim 1, wherein said computer terminal is located in a commercial establishment other than an establishment in which most revenue is derived from the sale of carpets, rugs, carpet tiles, and wall hangings.
13. The process of Claim 12 wherein said computer terminal is located in a commercial establishment selected from the group consisting of museum shops, sports shops, pet stores, and bookstores.
14. The process of Claim 1 wherein said computer terminal is located at a satellite location situated in a retail shopping environment.

- 5 15. The process of Claim 1 wherein said subject image is an original image that is digitized at said terminal, wherein said digitally-defined target design contains presentation enhancements, and wherein said presentation enhancements are selected from a collection of presentation enhancements accessible from said terminal.
- 10 16. The process of Claim 15 wherein said presentation enhancements may have a color and texture selectable at the time of said assembly.
17. The process of Claim 15 wherein said presentation enhancements are comprised of at least one enhancement selected from the group consisting of a background, a border, and a frame.
- 15 18. The process of Claim 1 wherein said step of assembling a digitally-defined target design includes a step which provides for the modification of color and texture of said presentation enhancements to be used as part of said digitally-defined target design.
- 20 19. The process of Claim 18, wherein said process makes available appropriate choices for subject images and presentation enhancements that comprise target images to allow a user to generate, on said selected substrate, a target image that coordinates with a specific set of independent interior design objectives to provide an aesthetically pleasing embellishment.
- 25 20. The process of Claim 19 wherein said independent interior design objectives are comprised of pre-existing interior furnishings that form the environment within which said target image on said selected substrate will be placed.
- 30 21. The process of Claim 1 wherein said step of assembling on said terminal a subject image and any associated artistic enhancements into a digitally-defined target design includes the step of electronically superimposing said subject image onto a selected backdrop whereby said backdrop extends beyond the edges of said subject image, thereby forming a border surrounding said subject image.
- 35

22. The process of Claim 21 wherein said backdrop forms a border of uniform width.
23. The process of Claim 21 wherein said backdrop is selected from a database,
accessible through said terminal, comprised of a group of available backdrops.
- 5 24. The process of Claim 23 wherein said backdrop may be augmented by additional
selections of color and texture.
25. The process of Claim 21 wherein said target design includes a colored area
surrounding said border and comprising a frame.
- 10 26. The process of Claim 1 wherein said step of assembling said digitally defined
target design includes a sequence of steps in which artistic selections may be
made and images responsive to such selections are generated for review until a
satisfactory target design has been assembled.
- 15 27. The process of Claim 1 wherein said step of assembling said digitally-defined
target design includes a step in which a dithered representation of said desired
subject image and any desired artistic enhancements is generated and displayed
on said terminal.
- 20 28. The process of Claim 27 wherein said step of assembling said digitally-defined
target design includes a step in which said dithered representation of said desired
subject image and any desired artistic enhancements may be geometrically
adjusted to provide an aesthetically pleasing image that is suitable for the specified
area of said substrate surface on which said digitally-defined target design is to be
placed.
- 25 29. The process of Claim 1 wherein said step of assembling said digitally-defined
target design includes a step in which adjustments to at least one display-related
attribute may be made.
- 30 30. The process of Claim 1 wherein the quantity of liquid colorant dispensed within
said given pixel is insufficient to oversaturate said given pixel.
- 35

31. The process of Claim 1 wherein the quantity of liquid colorant dispensed within said given pixel is sufficient to oversaturate said given pixel.
32. The process of Claim 31 wherein said oversaturation of said given pixel is the
5 result of the dispensing of at least two different colorants in said given pixel.
33. The product of the process of Claim 32.
34. The product of the process of Claim 32, wherein said subject image comprises a
10 scanned image of an original artistic work.
35. The process of Claim 1 wherein said dispensing of controlled quantities of liquid colorant, on a pixel-by-pixel basis onto said specified area of said substrate surface, results in the application of liquid colorant in a first pixel and the migration
15 of said colorant from said first pixel to a second, contiguous pixel.
36. The process of Claim 35 wherein said dispensing additionally results in the application of liquid colorant in said second, contiguous pixel, wherein said quantity applied in said second pixel is insufficient to saturate fully said second pixel.
20
37. The process of Claim 1 wherein said dispensing, on a pixel-by-pixel basis onto said specified area of said substrate surface, of controlled quantities of liquid colorant, results in the dispensing, within a given pixel in said specified area, of a first colorant and a second colorant, thereby forming a mixture of said first colorant and
25 said second colorant within said given pixel.
38. An Internet-based system for enabling a user at a design terminal to access a digitally-defined subject image and customize said subject image to form a digitally-defined target design for decorating a textile substrate on a remotely-
30 located automated patterning apparatus, said automated patterning apparatus comprising a plurality of individually-actuated colorant applicators through which corresponding respective liquid colorants may be selectively applied, in pixel-wise fashion, to the surface of said substrate in accordance with said digitally-defined pattern, said system comprising:

a) a software interface for enabling remote access, by said user at said design terminal, to an image manipulation design tool over a public communications network;

b) an access device by which said digitally-defined subject image selected by said user may be functionally acquired by said image manipulation design tool, said tool enabling said user to customize said digitally-defined subject image with the addition of artistic enhancements to form said digitally-defined target design;

c) a dithering algorithm by which a dithered image may be generated from said digitally-defined target design using a dithering palette of colors, said palette being comprised of colors that can be generated at specified pixel locations on said substrate by the pixel-wise application of selected of said liquid colorants, individually and, alternatively, in various combinations, to said substrate; and

d) a patterning device control system for transforming said dithered image into appropriate instructions for the actuation of each of said colorant applicators, by which a respective liquid colorant from each actuated color applicator may be selectively applied to said substrate in accordance with said instructions, thereby reproducing said digitally-defined target design on said substrate.

39. The system of Claim 38 wherein said control system comprises a look-up table that associates the color of each pixel comprising said dithered image with a dispensing instruction for at least one colorant applicator.

40. The system of Claim 38 wherein said dithering palette is comprised of colors that result from the *in situ* blending of at least two different liquid colorants within a given pixel.

41. The system of Claim 38 wherein said dithering palette is comprised of colors that result from the blending of at least two different liquid colorants within a given area on the surface of said substrate, and wherein the application of at least one of said colorants oversaturates said substrate within a first portion of said given substrate

area, and wherein the application of another of said colorants undersaturates said substrate within a second portion of said given substrate area, said second portion being contiguous with said first portion.

- 5 42. The product of the process of Claim 38, wherein said subject image comprises an artistic work authored by said user.
- 10 43. The Internet-based system of Claim 38 wherein said user customization of said digitally-defined subject image to form said target image includes the addition of presentation enhancements.
- 15 44. The Internet-based system of Claim 43 wherein said presentation enhancements include a desired decorative surround that, when said subject image is combined with said surround, forms a decorative border surrounding said subject image.
- 20 45. The Internet-based system of Claim 43 wherein said image manipulation design tool electronically combines said subject image and said desired decorative surround to form a target design.
- 25 46. The Internet-based system of Claim 38 wherein said image manipulation design tool provides the user with the ability to make adjustments to the texture and color of said target design and of said presentation enhancements.
47. The Internet-based system of Claim 46 wherein a dithered representation of said adjustments is generated and displayed on said terminal.
48. The Internet-based system of Claim 47 which further includes a step in which adjustments to at least one display-related attribute may be made.
- 30 49. The Internet-based system of Claim 38 wherein said digitally-defined subject image is a scanned image of a photograph.
50. The Internet-based system of Claim 38 wherein said digitally-defined subject image is in the form of a digital file from a digital camera.
- 35

51. The Internet-based system of Claim 38 wherein said digitally-defined subject image is in the form of an output from a video frame grabber device.
52. The Internet-based system of Claim 38 wherein said digitally-defined subject image comprises an archived image from an electronic data base.
53. The Internet-based system of Claim 38 wherein said digitally-defined subject image comprises an image downloaded from the Internet.
54. The Internet-based system of Claim 38 wherein said digitally-defined subject image comprises one or more lines of text.
55. The Internet-based system of Claim 38 wherein said dithered image is stored on appropriate media and is made available to said patterning control system via said media.
56. The Internet-based system of Claim 38 further comprising the step of generating a Source SKU and a Target SKU, wherein said Source SKU comprises a plurality of data fields adapted to accommodate data necessary for billing, manufacturing, and shipping of said textile substrate bearing said target design, and wherein selected of said plurality of data fields comprising said Source SKU are adapted to accommodate data necessary for the specification of said target image as customized by said user.
57. The Internet-based system of Claim 56 wherein said Source SKU is comprised of a Product Specification Template that includes data that is customizable by said user and data that is non-customizable by said user.
58. The Internet-based system of Claim 56 wherein said Target SKU is comprised of customizable data and non-customizable data, and wherein said Target SKU is used to specifically identify said substrate bearing said target design during the manufacturing process.
59. The Internet-based system of Claim 58 wherein, following the manufacturing process, the Target SKU is discarded.

- 5 60. An interactive method for generating a decorative textile substrate on an automated patterning apparatus that directs pre-determined quantities of liquid colorants through a set of individually-addressable colorant applicators, said liquid colorants being selectively applied by said applicators to individual pixels on the substrate in accordance with digitally-encoded pattern data, said method comprising:
- 10 a) providing a user with remote access to an image manipulation design tool over a public communications network;
- 15 b) importing a digitized image selected by said user into said image manipulation design tool;
- c) enabling said user to customize said digitized image via said image manipulation design tool to form a desired target design to be transferred to said textile substrate;
- 20 d) generating an order comprising pattern data corresponding to said desired target design;
- e) communicating said pattern data to said automated patterning apparatus; and
- 25 f) generating appropriate actuation instructions for each of said color applicators associated with said patterning apparatus necessary to reproduce said target image on said decorative textile substrate in accordance with said pattern data.
- 30 61. The interactive method of Claim 60 wherein said step (c) further includes the step of generating a dithered image from said desired target image using a dithering palette of colors, said palette being comprised of colors that can be generated at specified pixel locations on said textile substrate using said selectively applied liquid colorants.

62. The interactive method of Claim 60 wherein said step (e) comprises communicating said pattern data electronically over said public communications network.
- 5 63. The interactive method of Claim 60 wherein said step (e) comprises communicating said pattern data via physical transfer of computer media.
64. The interactive method of Claim 60 wherein said step (f) comprises use of a look-up table in which said digitally-encoded pattern data may be transformed into a set of individual colorant applicator actuation instructions for each colorant necessary to reproduce said given color on said substrate.
- 10
65. The interactive method of Claim 60 further comprising the step of generating a Target SKU comprising a temporary instruction file containing instructions for creating said decorative textile substrate, said temporary instruction file being associated with a pre-defined Source SKU maintained for pricing purposes.
- 15
66. The interactive method of Claim 65 further comprising the step of discarding said Target SKU comprising said temporary instruction file, including instructions for creating said decorative textile substrate, following manufacture of said decorative textile substrate.
- 20
67. A system allowing a user to generate a customized design and pattern a decorative textile substrate therewith through the use of an automated patterning apparatus, said automated patterning apparatus comprising a plurality of individual colorant applicators through which pre-determined quantities of respective individual colorants may be directed onto said substrate in accordance with pattern data corresponding to said customized design, said system comprising:
- 25
- 30
- a) a computer software interface device providing access to a remotely-located image manipulation design tool over a public communications network;
- b) a database for storing a plurality of digitized images capable of being incorporated into said customized design through use of said design tool;
- 35

c) an Internet-based communication presented to said computer software interface device for enabling user selection of a digitized image and initiating input of a selected image as a desired target image to said image manipulation design tool;

d) a dithering mechanism for generating a dithered image from said desired target image using a dithering palette of colors, said palette being comprised of colors that can be generated at specified locations on said substrate using said individual colorants; and,

e) an Internet-based communication presented to said computer software interface device for enabling user generation of an order comprising pattern data corresponding to said dithered target image for download to said apparatus; and

f) a mechanism receiving said generated order over said public communications network and generating appropriate dispensing instructions for each of said color applicators necessary to reproduce the dithered image on said substrate.

68. The system of Claim 67 wherein said plurality of digitized images stored in said database includes a plurality of user selectable decorative backdrops upon which said dithered image may be superposed.

69. The system of Claim 67 wherein said plurality of digitized images stored in said database includes a plurality of user selectable decorative surrounds for surrounding said dithered image, said dithered image and said decorative surround collectively defining a target image from which said pattern data are derived.

70. The system of Claim 67 wherein said computer software interface device providing interface for enabling remote access to an image manipulation design tool is located remotely from said automated patterning apparatus.

71. An interactive method to allow a user, from a remote location, to generate a custom design and to provide for the patterning of a decorative textile substrate with said custom design using an automated patterning apparatus, said apparatus

comprising a plurality of process colorants that can be individually directed onto said substrate in accordance with pattern data derived from said custom design, said method comprising:

- 5 a) providing said user with access to an image manipulation design tool over a public communications network;
- 10 b) providing said user with access to a database containing a plurality of pre-defined candidate artistic elements, which may include subject images and artistic enhancements, capable of being incorporated into said custom design;
- 15 c) providing a review and selection process by which said user can review and incorporate into said custom design, on a trial basis, a plurality of said candidate artistic elements prior to making a final selection of at least one of said elements;
- 20 d) allowing said user to utilize said image manipulation design tool to modify, as desired, said final selection of said elements incorporated into said custom design to provide customization of said elements by said user to form, from said custom design, a custom target image to be transferred to said textile substrate; and
- e) communicating said target image to said automated patterning apparatus.

72. The method of Claim 71 wherein said target image is communicated over said public communication network

73. The method of Claim 71 which further comprises the step of generating dispensing instructions whereby said process colorants associated with said patterning apparatus may be individually directed on said decorative textile substrate in accordance with said custom target image.

74. The method of Claim 71 wherein at least one of said artistic elements is a user-supplied image comprising a subject image, and wherein said image is digitized and imported into said image manipulation design tool for incorporation into said custom design.

- 5
75. The interactive method of Claim 71 wherein said decorative textile substrate bearing said target image is associated with a Product Specification Template, said method further including the step of forming an SKU based on data contained in said Product Specification Template.
- 10
76. The interactive method of Claim 75 wherein said Product Specification Template is comprised of data that is customizable by said user and data that is non-customizable by said user.
- 15
77. The interactive method of Claim 75, further comprising the step of generating a Target SKU comprising a temporary instruction file containing instructions for creating said decorative textile substrate, said temporary instruction file further containing data from said Product Specification Template.
- 20
78. The interactive method of Claim 77, further comprising the step of deleting said Target SKU comprising said temporary instruction file, including instructions for creating said decorative textile substrate, following manufacture of said decorative textile substrate.
- 25
79. The interactive method of Claim 71 wherein said step c) further includes the step of dithering said desired target image using a dithering palette of colors comprised of colors that can be generated at specified pixel locations on said textile substrate by the selective application of said process colorants by said automated patterning apparatus.
- 30
80. The method of Claim 79 wherein said step c) further includes the step of developing a desired backdrop that, when said dithered image is superimposed thereon, will form an appropriately proportioned decorative border surrounding said dithered image, and electronically superimposing said dithered image onto said desired backdrop, thereby forming a dithered image having an appropriately proportioned decorative border comprised of said desired backdrop.
- 35
81. The product of the process of Claim 74, wherein said subject image comprises an original artistic work.

- 5 82. A computer-readable medium containing instructions data for patterning a textile substrate by the selective application of a plurality of colorants to the surface of said substrate through a set of individually-addressable colorant applicators, wherein said pattern data is generated by steps a) through d) of the method of Claim 71.
- 10 83. A computer-readable data transmission medium containing a data structure comprising instructions for patterning a textile substrate by the selective application of a plurality of colorants to the surface of said substrate through a set of individually-addressable colorant applicators, wherein said data structure comprises specification, in computer-readable form, of values for a Product Specification Template.
- 15 84. The computer-readable medium of Claim 83 wherein said instructions are generated by the method of Claim 71.
- 20 85. The medium of Claim 83 wherein said data structure contains data specifying a Target SKU.
- 25
- 30
- 35 86. The medium of Claim 83 wherein said data structure contains data specifying only user-specified elements of said Product Specification Template.